

WHAT IS CLAIMED IS:

1. A method for increasing accuracy for locating a cellular mobile station in an urban area, comprising the following steps:

1) determining whether there is any synchronous measurement request, and if yes, initiating the synchronous measuring management for an assistant locating apparatus (including opening and closing transmission of RTD measuring pilot frequency); otherwise proceeding to the next step;

2) determining whether there is any locating request, and if yes, determining approximate location of the mobile station to be located with time of arrival, TDOA, and sector information of a base station; otherwise returning to step 1;

3) determining whether to open or close transmission of locating pilot frequency from an adjacent assistant locating apparatus according to the approximate location of the mobile station;

4) if an assistant locating pilot frequency is opened, measuring the TDOA again, and then determining whether the measurement for the mobile station to be located is finished; if yes, closing the transmission of the locating pilot frequency from the assistant locating apparatus; otherwise repeating the determination step;

5) searching for and processing multi-paths and identifying NLOS paths according to channel codes of the mobile station to be located, and requesting the assistant locating apparatus to report NLOS path identification result; and

6) estimating the location of the mobile station with the measurement of assistant pilot frequency signals and NLOS path identification result to obtain a more accurate location of the mobile station.

2. A method according to claim 1, wherein the transmission of the assistant pilot frequency and the transmission of the RTD measuring pilot frequency are both carried out intermittently.

3. A method according to claim 2, wherein the transmission of the assistant pilot frequency and the transmission of the RTD measuring pilot frequency are both carried out in an independent transmission mode.

4. An assistant locating apparatus implementing claim 1, comprising an air interface transmitting/receiving antenna, a transmitting/receiving unit B wired to the air interface transmitting/receiving antenna, and a channel-processing unit B wired to the transmitting/receiving unit B, wherein the assistant locating apparatus also comprises:

a locating measurement unit-oriented antenna that opens/closes transmission of the RTD measuring pilot frequency;

a mobile station-oriented transmitting/receiving antenna that opens/closes transmission of the assistant locating pilot frequency;

a transmitting/receiving unit A that is connected to the locating measurement unit-oriented antenna and the mobile station-oriented transmitting/receiving antenna via a first feed line and a second feed line, wherein said transmitting/receiving unit A comprises a transmitting unit and a receiving unit, and wherein said transmitting unit sends RF signals to said locating measurement unit-oriented antenna and the mobile station-oriented transmitting/receiving antenna independently through symmetric circuits, and wherein the channel-processing unit A controls transmission time and modulation mode of said RF signals, wherein said receiving unit comprises an RF filter, a down frequency converter, and a multi-path receiver, and wherein said receiving unit is controlled by the channel-processing unit A and at the same time providing maximum ratio consolidation output and multi-path distribution output;

a channel-processing unit A which mainly comprises a demodulating/decoding unit, an assistant locating pilot frequency or RTD measuring pilot frequency codes generating unit, an assistant locating pilot frequency transmission control unit, and a RTD pilot frequency transmission control unit;

an LOS path identification unit which identifies LOS paths and NLOS paths according to multi-path distribution of the LOS paths and the NLOS paths;

a managing unit, which is responsible for communicating with a base station controller as well as for controlling the LOS path identification unit, channel-processing unit A, and channel-processing unit B.

5. An assistant locating apparatus according to claim 4, wherein the first feed line is similar to the second feed line in length.

6. A method for increasing accuracy for locating a cellular mobile station in an urban area, the method comprising the steps of:

- 1) determining whether there is a synchronous measurement request;
- 2) if there is no synchronous measurement request, proceeding to step 4);
- 3) if there is a synchronous measurement request, initiating synchronous measuring management for an assistant locating apparatus, including opening and closing transmission of RTD measuring pilot frequency;
- 4) determining whether there is a locating request;
- 5) if there is no locating request, going to step 1;
- 6) if there is a locating request, determining an approximate location of the mobile station to be located with a time of arrival, TDOA, and sector information of a base station;

7) determining whether to open and/or close transmission of a locating pilot frequency from an adjacent assistant locating apparatus according to the approximate location of the mobile station;

8) if an assistant locating pilot frequency is opened, measuring the TDOA again, and then determining whether the measurement for the mobile station to be located is completed;

9) if the measurement for the locating mobile station is completed, closing transmission of locating pilot frequency from the assistant locating apparatus, and if the measurement for the locating mobile station is not completed, repeating determination of whether the measurement for the locating mobile station is completed;

10) searching for and processing multi-paths, identifying NLOS paths according to channel codes of the mobile station to be located, and requesting the assistant locating apparatus to report NLOS path identification result; and

11) estimating location of the mobile station with measurement of assistant pilot frequency signals and the NLOS path identification result to obtain a more accurate location of the mobile station.

7. A method according to claim 6, wherein the transmission of the assistant pilot frequency and the transmission of the RTD measuring pilot frequency are both carried out intermittently.

8. A method according to claim 7, wherein the transmission of the assistant pilot frequency and the transmission of the RTD measuring pilot frequency are both carried out in an independent transmission mode.

9. An assistant locating apparatus comprising  
  
an air interface transmitting/receiving antenna;

a transmitting/receiving unit B connected to the air interface transmitting/receiving antenna;

a channel-processing unit B connected to the transmitting/receiving unit B;

a locating measurement unit-oriented antenna that opens/closes transmission of a RTD measuring pilot frequency;

a mobile station-oriented transmitting/receiving antenna that opens/closes transmission of an assistant locating pilot frequency;

a transmitting/receiving unit A that is connected to the locating measurement unit-oriented antenna and the mobile station-oriented transmitting/receiving antenna via a first feed line and a second feed line, respectively, the transmitting/receiving unit A comprises a transmitting unit and a receiving unit, wherein the transmitting unit sends RF signals to the locating measurement unit-oriented antenna and the mobile station-oriented transmitting/receiving antenna independently through symmetric circuits, wherein the channel-processing unit A controls transmission time and modulation mode of the RF signals, wherein the receiving unit comprises a RF filter, a down frequency converter, and a multi-path receiver, and wherein the receiving unit is controlled by the channel-processing unit A and at the same time provides maximum a ratio consolidation output and a multi-path distribution output;

a channel-processing unit A that comprises a demodulating/decoding unit, an assistant locating pilot frequency or RTD measuring pilot frequency codes-generating unit, an assistant locating pilot frequency transmission control unit, and a RTD pilot frequency transmission control unit;

a LOS path identification unit that identifies LOS paths and NLOS paths according to the multi-path distribution of LOS paths and NLOS paths;

a managing unit, which is responsible for communicating with a base station controller and for controlling the LOS path identification unit, channel-processing unit A, and channel-processing unit B.

10. An assistant locating apparatus according to claim 4, wherein the first feed line is similar to the second feed line in length.